

Q4 concl. , said receiver means and an opposite outlet end portion for propagation of said acoustic signal into said earcanal, and acoustic damper means supported within said outlet end portion of said passage of said tubular portion [, and means for coupling said].

21. (Amended) A high fidelity insert earphone assembly as defined in claim 19, wherein ~~each of~~ said [electrical coupling] circuit means includes a capacitor and a first resistor connected in series relation between said common cable and the corresponding one of said pair of separate cables [electrical signal source and one of said terminals of said receiver means], and a second resistor connected in parallel with the combination of said capacitor and said first resistor.

REMARKS

The thorough and constructive Office Action of May 6, 1993 is acknowledged with sincere appreciation. By this amendment, claims 3 and 18 are canceled without prejudice and claims 1, 2, 4-6, 12-16 and 19-21 are amended. Claims 7-11 and 17, which are dependent from amended claims, are resubmitted without amendment. Favorable consideration of the claims as now submitted is earnestly solicited.

Claim 1 is amended to overcome the indefinite feature noted by the Examiner and to more clearly distinguish from the cited prior art, this claim having been rejected as unpatentable over Kanbe in view of Langford and as unpatentable over McCabe in view of Langford.

Claim 1 is specifically directed to an insert earphone which achieves reproduction of sounds with very high fidelity and with a high degree of reliability while being readily and economically manufacturable. As noted in the introductory portion of applicants' specification, important aspects of the invention relate to the recognition and discovery of problems with prior art arrangements and their causes and to an analysis of what is necessary to overcome such problems and otherwise provide improved earphones. It was discovered that one serious problem with audiophile earphones has been related to the failure to recognize the need to compensate for loss of external-ear resonance when using an earphone and the failure to provide compensating acoustic characteristics between an earcanal of a user and the transducer or receiver used to develop an audio signal from an applied electrical signal. It was further discovered that features of a damped coupling assembly of the hearing aid disclosed in the Killion and Murphy paper, discussed at page 2, lines 2-9, might be applied with advantage to the construction of an audiophile earphone.

With a damped coupling assembly as disclosed in the Killion et al. paper, a damper is coupled through a tube to an output port of a receiver and is disposed within the tip of an earmold. The arrangement produces a frequency response which will compensate for the loss of external ear resonance and which is largely independent of the total length of the coupling between the receiver and the earmold tip.

In accordance with applicants' invention, a high fidelity

earphone construction is provided by which compensation for the loss of external-ear resonance is obtained, using the principles used in the hearing aid of the Killion et al. paper but with a construction which does not require a tube and which otherwise provides a high-fidelity earphone differing from the construction of the hearing aid of the Killion et al. paper to achieve important advantages thereover.

More particularly, as recited in claim 1 as originally filed, housing means are provided which serve the functions of connecting to an outlet port of receiver means and supporting damping means while also serving the important function of providing a sound passage extending between an outlet end of receiver means and the damper means. Claim 1 has now been amended to clarify that the receiver means is in acoustically sealed relation to one end of the passage and that the passage has a length such as to cooperate with the acoustic damper means to provide a damped coupling assembly operative to provide compensation for the loss of external-ear resonance. The result is an earphone which achieves reproductions of sounds with very high fidelity in the ears of an audiophile user. The earphone has been highly successful commercially and has received "rave reviews" by many in the audiophile industry.

It is respectfully submitted that the highly advantageous combination as specifically defined by claim 1 would not have been obvious from the prior art, particularly the Examiner's proposed combinations of Kanbe in view of Langford or McCabe in view of

Langford. The Examiner is especially invited to consider what would have been obvious from the prior art references without the benefit of applicants' disclosure, rather than what can be made out from the references after considering applicants' disclosure.

The Kanbe reference teaches an earphone for underwater use in which high fidelity would not be a likely objective and in which, in any case, high fidelity could not possibly be achieved in any manner similar to the manner in which it is achieved in applicants' construction. Attention is respectfully invited to the statement that "water invades through the cylindrical part 12, or through the hole 15", resulting in acoustic characteristics quite different from those obtained in applicants' construction.

The McCabe patent discloses an electro-acoustic headset constructed as a modification of a headset which includes tubular sound-conducting elements to operate through acoustic signal transmission, of a type such as used in the cabins of large aircraft. McCabe observes that while such may be "appropriate for frequencies up to 5,000 to 6000 hertz, the system is inadequate for frequencies above that level due to the failure of transmission of high-frequency sound waves" (Col. 1, lines 18-21).

McCabe discloses a pair of earpieces each including a sound conducting channel 6 communicating with the end of one of a pair of sound conducting tubes 1a and 1b, the opposite ends of tubes 1a and 1b being connected to tubular plug contacts 3a and 3b. Each earpiece is formed with a short projection 7a and 7b, through which sound-conducting channel 6 extends, and which is adapted to

receive a replaceable tip 8a or 8b, also formed with a sound-conducting channel therethrough in alignment with channel 6. Projections 7a and 7b are formed with notches in the peripheral surface thereof adapted to receive corresponding projections on the tips 8a and 8b. Each McCabe earpiece is also provided with an internal chamber in the path of the sound-conducting channel 6 and adapted to receive a small electro-acoustic transducer 5. Conductors 4a', 4a", 4b' and 4b" extend from the transducers and through the sound conducting channels 6 and sound conducting tubes 1a and 1b to contacts 9a, 10a, 9b and 10b formed on the walls of the connecting tubes in proximity to the tubular plug contacts.

Thus McCabe provides paths for conduction of acoustic waves to the ears of the user from the plug contacts 3a and 3b and thence through the tubes 1a and 1b and the full length of channels 6, as well as from the transducers and through portions of the channels 6. It is not clear whether or not it is the intent that the transducers 5 could be used alone for generating the acoustic waves conducted. Whether or not such is the intent, it is clear that the conduction of acoustic waves from the transducers to the ear would be affected by the existence of the paths from the transducers 5 and through portions of the channels 6 and the tubes 1a and 1b to the plug contacts 3a and 3b. It is also clear that no problem with respect to performance of the headset is disclosed, particularly in view of the statement of an apparently realized object of the invention as being to "provide a headset which should efficiently transmit sound waves having frequencies both over and

under 5,000 to 6,000 hertz, while being light and inexpensive to manufacture". McCabe, col. 2, ll. 14-17. It is not obvious from McCabe, taken alone, that any changes should be made.

The Langford patent, like the Killion et al. paper, is directed to a hearing aid rather than a high fidelity earphone and does not suggest the problems in providing a high fidelity earphone which are recognized and solved by applicants. The Langford patent discloses an acoustic attenuator 41 mounted within a hollow shell 27 which has a closed end including an opening 28 formed by a tubular extension 29 for connection to one end of a tube 25 the opposite end of which connects to a sound transducer 17. It contains no suggestion or teaching of the possibility of using a damped coupling assembly to achieve compensation for the loss of external-ear resonance and to thereby achieve very high fidelity reproduction. The only reference to frequency response characteristics is at column 1, line 67-69, stating that "Such attenuators are useful to control the frequency response of the hearing aid, and to avoid overdriving the ear drum as a result of louder-than-normal sounds".

With regard to modifying the Kanbe construction in view of Langford, it is respectfully submitted that there would be no apparent purpose for attempting to provide an acoustic attenuator, such as disclosed by Langford, in the Kanbe construction in which water is present. An attenuator would make the structure less suitable for its intended underwater operation. Even it were suggested that the structure should be operated in air and even if

it were also suggested that an attenuator might be provided, and there are no such suggestions, it would not be possible to so install an attenuator or damper means in the short length of passage shown in the Kanbe reference as to provide a passage portion which could cooperate with a damper in the manner as claimed. Thus an unintended operation out of water and a substantial and unsuggested reconstruction would be required to produce a structure as claimed. It is respectfully submitted that such cannot properly be considered to have been obvious to one of ordinary skill in the art at the time of applicants' invention.

With regard to modifying the McCabe construction in view of Langford, here again there is no suggestion of any modification other than in the disclosure of this application. Moreover, even if it were expressly suggested to one of ordinary skill in the art that the attenuator of Langford should somehow be incorporated in the McCabe device, and there is no such suggestion, it is respectfully submitted that it still would not be obvious as to where and how the attenuator might be incorporated in an advantageous manner and how it might be incorporated without adversely affecting transmission of acoustic waves to the ears of the user from the plugs 3a and 3b and the sound conducting tubes. Perhaps more importantly, it is not obvious how any incorporation of the attenuator of Langford in the McCabe patent could possibly produce the structure as claimed in which the inlet of the claimed passage is in acoustically sealed relation to the outlet end of receiver means, and in which a portion of the passage cooperates

with a damper means to provide a damped coupling assembly operative to provide compensation for a loss of external-ear resonance.

It is therefore respectfully submitted that in the absence of the disclosure of this application, it clearly would not have been obvious to one of ordinary skill in the art at the time of applicants' invention that the references could so combined as to produce the advantageous combination as defined by claim 1. Allowance of claim 1 is earnestly solicited.

Claim 2 is dependent from claim 1 and has been amended to be consistent with claim 1 as amended. It is specific to the provision of an internal shoulder in the passage engaged by one end of the tubular support member of the damper means, a feature not suggested in the references, and allowance of claim 2 along with claim 1 is earnestly solicited.

Claim 4 is amended to be an independent claim and to add limitations to be specific to the feature in which the resilient mounting means includes resilient foam material compressed during assembly between an end surface of the receiver means and an inside of an end wall of the chamber means and also between an outer surface of the receiver means and an inner surface of the outer wall of the chamber portion. This claim was rejected along with claim 1 on a proposed combination of Kanbe in view of Langford and on a proposed combination of McCabe in view of Langford and, for reasons advanced above in support of claim 1, it is respectfully submitted such proposed combinations would not have been obvious to one of ordinary skill in the art at the time of applicants'

invention.

It is further submitted that the feature specifically defined by the added limitations is clearly not suggested by the references. The Examiner referred to element 19 of Kanbe in rejecting claim 4 as originally presented. Attention is respectfully invited to the fact that Kanbe requires a water tight seal and to the fact that the element 19 of Kanbe serves to exert forces on the right side of the drive unit as shown to hold portions on the left side of the drive unit 18 in direct contact with portions of the mounting structure. It is also noted that the periphery of the larger diameter left-hand portion of the drive unit being shown in direct contact with an inner surface of the mounting structure. The element 19 of Kanbe cannot be considered to be compressed between an end wall from which a tubular portion projects in the manner as claimed, nor between an outer peripheral surface of receiver means and an inner surface of an outer wall of a chamber portion as claimed. Moreover, element 19 of Kanbe does not serve the advantageous function of minimizing noise and vibrations as performed by the resilient mounting means as claimed, but serves the opposite function of holding the drive unit in direct contact with the housing structure as shown. Allowance of claim 4 is earnestly solicited.

Claim 5 is dependent from claim 4 and is specifically directed to the feature in which the resilient foam material is in the form of a generally rectangular piece of sheet material having a central opening through which the output tube is inserted.

Neither the Kanbe patent nor any other reference has any suggestion of this feature. Allowance of claim 5 is earnestly solicited.

Claim 6 is amended to be an independent claim and to add limitations to be directed specifically to the feature by which an end section of the tubular portion of the housing means is of an enlarged size to provide both internal and external shoulders which fix the position of the damper means and retain the acoustic coupling means in the advantageous manner set forth. This claim was rejected along with claim 1 on a proposed combination of Kanbe in view of Langford, further in view of Kelsey. For reasons like those advanced above in support of claim 1, it is respectfully submitted such a proposed combination would not have been obvious to one of ordinary skill in the art at the time of applicants' invention. It is further submitted that the feature defined by the added limitations is clearly not suggested in the references. Neither Kelsey nor any other reference suggests the enlargement of an end section of a tubular portion to provide internal and external shoulders serving the advantageous functions as set forth. Allowance of claim 6 is earnestly solicited.

Claims 7-11 are dependent from claim 1 and are respectfully submitted to be allowable along with claim 1. These claims are directed to features which are advantageous in combination with the features defined by claim 1 and which are not suggested by the references. With particular reference to claims 10 and 11, it is noted that these claims were rejected on Kanbe in view of Langford, further in view of Killion ('679) or Marutani.

As correctly noted by the Examiner, Killion ('679) teaches an equalization circuit as recited, but in an insert earphone of a type designed for use in ABR (Auditory Brainstem Response) audiometry, a highly specialized field in which minute electrical signals are measured that can be picked up on the head. In such use, it is highly desirable that the transducer means be at some distance from the head as disclosed by Killion ('679) so that its electromagnetic field will not interfere with measurement of such minute electrical signals. It is submitted that it would not be obvious to one of ordinary skill in the art relating to high fidelity earphones for audiophile use, incorporating a receiver in close proximity to the ear and of otherwise different physical construction, would look to the ABR audiometry art and recognize the advantage of using the network 40a of Killion ('679). With regard to the Marutani patent, attention is respectfully invited to the fact that the network of Marutani does not include the second resistor recited in claim 10 and does not otherwise suggest the network as claimed.

Claim 12, directed to an earphone subassembly, has been amended in a manner similar to claim 1 and is respectfully submitted to be allowable, along with claim 13 dependent therefrom, for the reasons advanced in support of claims 1 and 2.

Claims 14 and 15, also directed to earphone subassemblies, have been amended to be independent claims similar to claims 4 and 6 and are respectfully submitted to be allowable for the reasons advanced in support of claims 4 and 6.

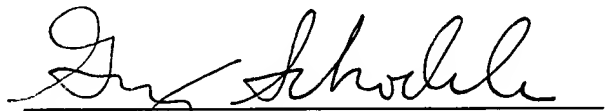
Claim 16 has been amended to incorporate the limitations of original claim 18, which is canceled, and to more clearly define the advantageous method of making an earphone as disclosed by applicants. For reasons similar to those advanced above in support of claim 1, it is respectfully submitted that the combination of method steps as defined would not have been obvious to one of ordinary skill in the art, without the benefit of the disclosure in this application. Attention is also invited to the fact that the references do not suggest provision of a receiver having an outlet tube and the insertion of the outlet tube into one end of a passage during assembly in the manner as recited in the claim. Allowance of claim 16, along with claim 17 dependent therefrom, is earnestly solicited.

Claim 19 has been amended to more clearly recite the connections between the electrical coupling means in the junction unit, the common cable and the terminal means of the receiver means and to bring out that each of the electrical coupling means is operative to increase the drive signal applied to the corresponding receiver means as a function of frequency. The McCabe patent, on which claim 19 was rejected, is discussed in detail above in connection with claim 1 and clearly does not suggest the features specifically set forth in claim 19. Attention is particularly invited to the fact that the connecting wires 4a and 4b are positioned within the tubes 1a and 1b which extend from the earpieces 2a and 2b to the plugs 3a and 3b. There is clearly no suggestion of any electrical coupling means having circuit means as

recited, and particularly no suggestion of providing such coupling means in a junction unit as recited, a feature which is highly advantageous in that the earphones can be smaller and of lighter weight than would be the case if the coupling means and the circuit means thereof were located in the earphones and in that the junction unit is a particularly convenient place for location of the coupling means and circuit means thereof. Allowance of claim 19, along with claims 20 and 21 dependent therefrom, is earnestly solicited.

A favorable action is earnestly solicited.

Respectfully submitted,

A handwritten signature in dark ink, appearing to read 'Gregory C. Schodde', is written over a horizontal line.

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Attachment

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